Dispersant Application Observer Job Aid

NOAA/NOS/Hazardous Materials Response Division
Seattle, Washington

This job aid was prepared as a companion field guide for individuals who have completed training in dispersant application observation. It is designed to be a refresher on observing and identifying dispersed and undispersed oil, describing their characteristics, and reporting this information to decision-makers. We recommend that this book be used with the *Open Water Oil Identification Job Aid for Aerial Observation* to help describe both surface oil and dispersed oil.

Photos for this document were provided by Dr. Ron Goodman, Imperial Oil Resources; Mr. Charles Huber, Mobil Oil; Dr. Per Daling, IKU Petroleum Research; and Dr. John Fraser. Allan A. Allen, Spiltec, and Dr. Robert Fiocco, Exxon, provided technical advice.

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Dispersion: The breaking of an oil slick into small droplets mixed into the water column as a result of breaking waves, other sea surface turbulence, and the action of chemical dispersants.

Emulsification: The formation of a water-in-oil mixture. The tendency for emulsification to occur varies with different oils and is much more likely to occur under high energy conditions (winds and waves, oil well blowouts). This mixture is frequently referred to as mousse.

Sheen: Sheen is a very thin layer of oil (0.0003 mm or less) floating on the water surface and is the most common form of oil seen in the later stages of a spill. Sheens vary in color according to their thickness, ranging from rainbows for the thicker layers, to grays, silvers, and almost transparent for the thinnest layers.

Slick: Oil spilled on the water that absorbs energy and dampens out the surface waves, making the oil appear smoother or "slicker" than the surrounding water.

REMEMBER...

While observing dispersant applications, remember these important points:

- The monitoring observer does not make operational decisions (e.g., how much dispersant to apply, when or where to apply it). These decisions are made by operational units.
- Oil surface slicks and plumes look different for many reasons; for example, oil or product characteristics, time of day (different sun angles), weather, sea state, rate at which oil disperses.
- Low-contrast conditions (e.g., twilight, haze) make observations difficult.
- For best viewing, the sun should be behind you, with the aircraft at an altitude of 500-1000 feet observing the slick at a 30-degree angle.
- Appearances of dispersant action can range from brown to white (cloudy) to no visible plume. The visibility of the dispersed plume will vary according to water clarity. In some cases, remaining surface oil and sheen may mask oil dispersing under the slick and thus interfere with observations of the dispersed oil plume.
- Sometimes other things, such as suspended solids or algal blooms, may resemble dispersed oil.
- Dispersed oil plume formation may not be instantaneous after dispersant application. In some cases, such as when oil is emulsified, it can take several hours and may not show a visible plume at all.

- A change in the appearance of the treated slick versus an untreated slick might indicate that the dispersant is working.
- A visible cloud in the water column indicates that the dispersant is working.
- It is difficult to determine whether the dispersant is working when no cloud is visible in the water column.
- The initial application may have a herding effect on the oil, making the slick appear to be shrinking when, in fact, the dispersant is "pushing" the oil together. This effect may cause the oil slick to visibly disappear from areas of the sea surface for a short time.
- Dispersed oil plumes are often highly irregular in shape and vary in oil thickness. This may lead to errors in estimating dispersant efficiency.
- It might not be possible to determine the thickest area of oil concentration. The actual dispersant application dose will vary according to the oil thickness. This will lead to overdoses and underdoses of dispersant and variations in the effectiveness of application. The observer should note these variations.

REMEMBER...

- Boat wakes through oil may appear to be a successful dispersion of oil. However, this could be just the vessel wave breaking a path through the oil, either physically parting the oil or mechanically dispersing it. Mechanically dispersed oil will recoalesce and float to the surface.
- Observers may see color changes in emulsions due to reduced water content and viscosity, and changes in the shape of the slick due to the demulsification action of the dispersant, which enhances the dispersion.
- Different observers at the same site may reach different conclusions about how much of the slick has been dispersed. This explains the importance of standard reporting criteria and training of individuals with a common set of guidelines.
- Observers need to report the presence of marine mammals, turtles, and birds in the area of dispersant application.

This is a side view of a DC-4 during dispersant application methods tests by the Southern California-Petroleum Contingency Organization and API in September 1978 and 1979. The dispersant has been dyed for increased visibility.

Dispersant application from a C-130 Hercules using an Aerial Dispersant Deployment System (ADDS). The dispersant has been dyed red for experimental purposes.

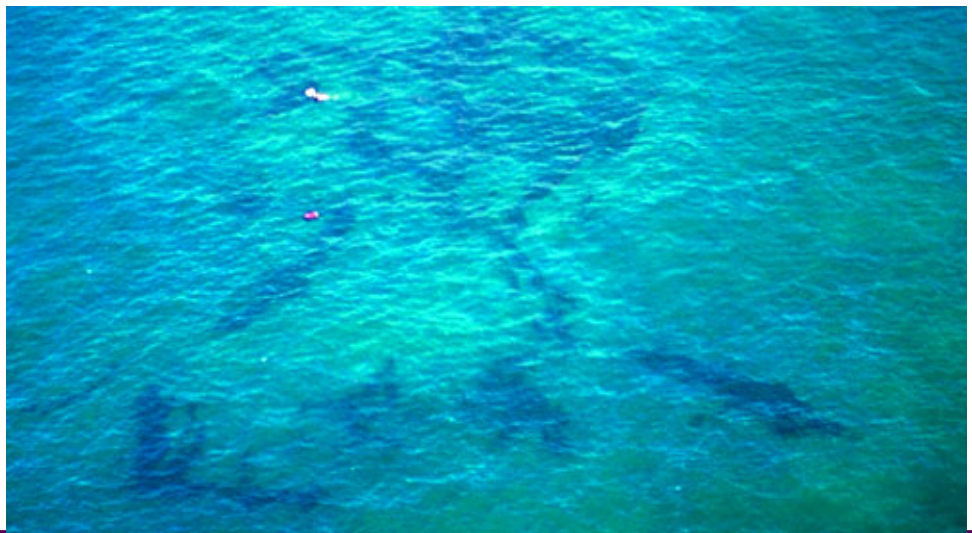
A helicopter applying dispersant using a bucket spray unit (side and top views).

Dispersant application from a ship (front and rear views).

A change in the appearance of a dispersant-treated slick versus an untreated slick may indicate that the dispersant is working. This photograph and the one on page 10 are from an experimental spill of about 1 cubic meter (approximately 265 gallons) of a medium Venezuela Lago Medio crude oil. This experimental spill took place offshore Newfoundland, October 18-21, 1981. Pictured above is the control slick (no dispersant) about 1 hour after release. Note the dark oil and sheen on surface.

DISPERSANT APPLICATION TO AN EXPERIMENTAL SLICK

This photo shows remains of the dispersant treated slick as seen 1 hour later. Note that the subsurface plume is now a light brown and is dissipating. Many trials have indicated that dispersants appear to modify the spreading rates of oils, and that within a few hours treated slicks cover much larger areas than control slicks.



Release of 20 cubic meters (5,300 gallons) of Sture blend crude, weathered for 35 hours before treatment. In the photo, a helicopter applies 800 liters (5 barrels or 211 gallons) of COREXIT 9500 to the oil. Due to the combination of cloudy weather conditions and the oil forming a very dark emulsion, it was difficult for the application helicopter to differentiate thicker, emulsified oil from thinner oil films and sheens.

NOFO Trials, 1994

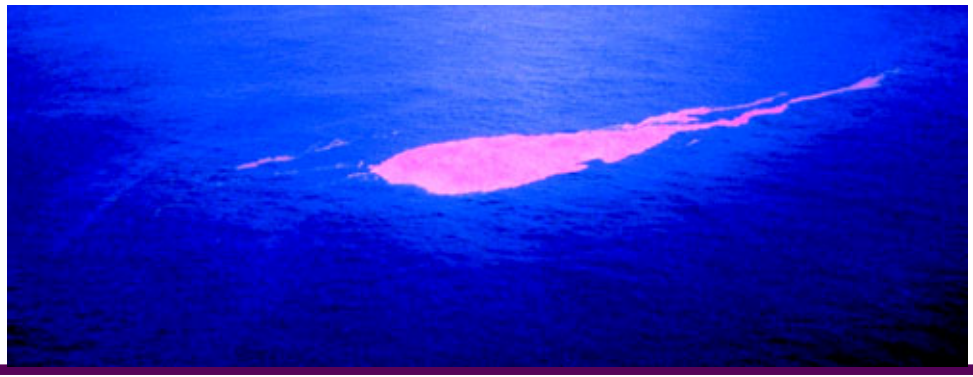
Researchers reported that despite poor conditions for visually observing dispersed plume development, oil was dispersed and the dispersed plume was documented by water column measurements. Shown here is the "herding" effect on the thin oil film area - application same as the previous photo.

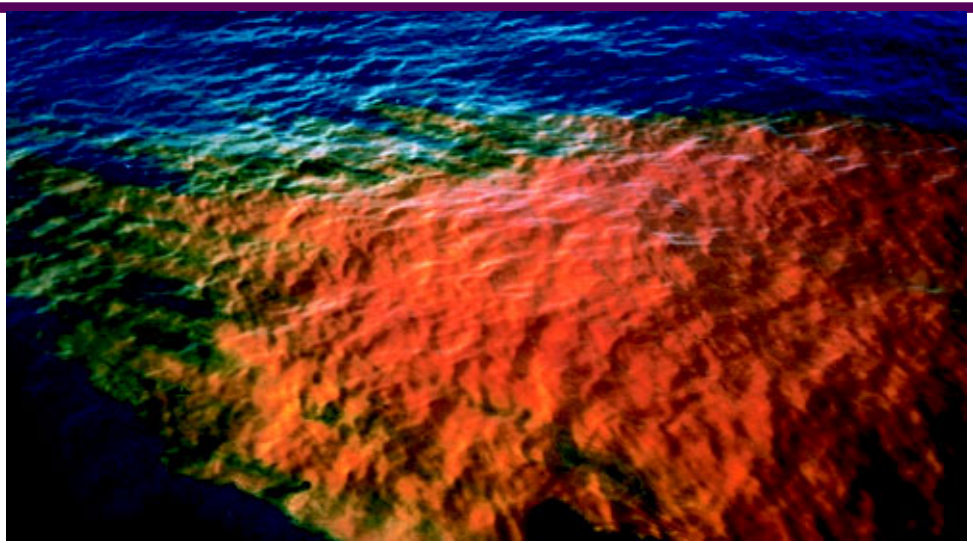
This series of three photographs shows dispersant application during the Exxon Valdez spill in 1989. This photograph shows the first application to thick dark oil. Note sheen being driven over areas where dispersant has been applied. This is due to wind and current moving the surface oil faster than the subsurface dispersed oil, which is moving by current alone. There is no visible subsurface plume. (Time: 14:52)

Slick breaking up about 30 minutes after the third dispersant application. A subsurface plume is now visible. (Time: 15:24)

The slick an hour after the previous photo. Note that some of the slick was not sprayed and remains on the surface. The surface oil is moving faster than the dispersed plume due to wind effects. Dispersed oil plume formation may not be instantaneous after dispersant application. In some cases, such as when oil is emulsified, it can take several hours and may not show a visible plume at all. (Time: 16:41)

On December 15, 1995, 117 cubic meters (31,000 gallons) of a light crude was spilled from a platform 35 miles from land in water deeper than 10 meters. The observer was with the controller in a Bell 206 Long Range helicopter, 500 feet above the water. At 15 50 on December 16, the DC-4 began spraying COREXIT 9527 50 feet above the water. Approximately 20 minutes after spraying, the slick appeared to have a "glossy" look. The DC-4 pilot reported, "The oil at first appeared as a reddish orange. After spraying about 10 to 15 minutes, the oil color appeared to change to a much darker reddish-brown. No milkiness was observed."



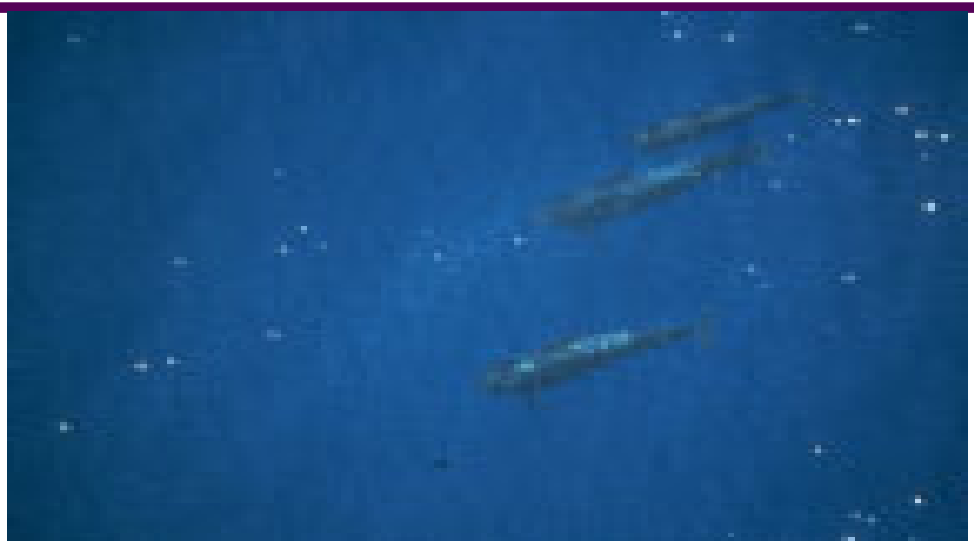


Forty minutes after the dispersant application the observer aboard the helicopter noted, "The lighter areas seemed to dissipate quickly after spraying. The heavy orange area seemed to be holding its shape, but water could now be seen starting to cover the outer 20 feet or so around the perimeter."

At 0700 the next day the observer on the helicopter reported, "The spill had split in half. The outer area of the larger spill seemed to be breaking up with silver traces leading out in the direction the wind was blowing. Only the center 100 feet was brown in color."

Boat wakes through oil may appear to be successful dispersion of oil. However, this could be just the vessel wake breaking a path through the oil, either physically parting the oil or mechanically dispersing it. Mechanically dispersed oil will recoalesce and float to the surface.

Birds, turtles, and marine mammals need to be reported if they are in the dispersant application area. This photo shows a herd of manatees swimming below the surface. You can see the paddle shape of the tail.



Whales may form patterns in the water that can be confused with dispersing oil.

This photo shows a turtle swimming below the surface.

Names of observers (agency)_____

Platform_____

Date of application_____

Time of application commencement/completion_____

Weather conditions (air temperature, wind speed, direction)_____

Tide and current_____

Water temperature, depth, and sea state_____

Visibility_____

Altitude (Observation and application platforms)_____

Application method (aerial/vessel) and rate_____

Type of oil_____

Oil properties (specific gravity, viscosity, pour point, etc.)_____

DISPERSANT APPLICATION OBSERVATION REPORTING

Name of dispersant _____

Location/distance from shore/identified sensitive areas _____

Surface area of slick _____

Operational constraints imposed by agencies _____

Percent of slick treated _____

Visual appearance of application _____

Re-coalescence (reappearance of oil) _____

Presence of wildlife (any impacts, e.g., fish kill) _____

Lessons learned _____

Photographic documentation _____